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NOVEL NITROGEN-BASED ORGANOSULFUR ELECTRODES FOR
ADVANCED INTERMEDIATE TEMPERATURE BATTERIES

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Advanced secondary batteries operating at intermediate temperatures (100 to 200°C) have attracted considerable interest due to their inherent advantages (reduced corrosion and safety risks) over higher temperature systems. Current work in this laboratory has involved research on a novel class of intermediate temperature Na/beta"-alumina/RSSR batteries conceptually similar to Na/S cells, but operating within a temperature range of 100 to 150°C, and having an organosulfur rather than inorganic sulfur positive electrode. The organosulfur electrodes are based on the reversible, two electron reduction of organodisulfides to the corresponding thiolate anions, $\text{RSSR} + 2\text{e}^- \rightarrow 2\text{RS}^-$, where R is an organic moiety. Among the advantages of such a generic redox couple for battery research is the ability to tailor the physical, chemical, and electrochemical properties of the RSSR molecule through choice of the organic moiety. The viscosity, liquidus range, dielectric constant, equivalent weight, and redox potential can in fact be verified in a largely predictable manner. The current work concerns the use of multiple nitrogen organosulfur molecules, chosen for application in Na/RSSR cells for their expected oxidizing character. In fact, a Na/RSSR cell containing one of these materials, the sodium salt of 5-mercapto-1-methyltetrazole, yielded the highest open circuit voltage obtained yet in our laboratory; 3.0 volts in the charged state and 2.6 volts at 100% discharge. Accordingly, the cycling behavior of a series of multiple nitrogen organodisulfides as well as polymeric organodisulfides are presented in this manuscript.